Dehcho Boreal Caribou Study Progress Report, April 2014

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Photo Credit Nic Larter – ENR

The Dehcho boreal caribou study was initiated in 2004 with the deployment of ten satellite collars on adult female caribou at the request of, and after consultation with Sambaa K'e Dene Band (SKDB) of Trout Lake. Extensive consultations in response to requests from other First Nations since have increased the study area and number of First Nations partners in this study. From 2004-2014 a total of 125 collars (mostly ARGOS DS or GPS) have been deployed on adult female boreal caribou (Appendix 1, Figure 1). A more detailed background history of the program, the collars used, and the deployment procedures can be found in Larter and Allaire (2010). This report provides updated results and new information from another year of data.

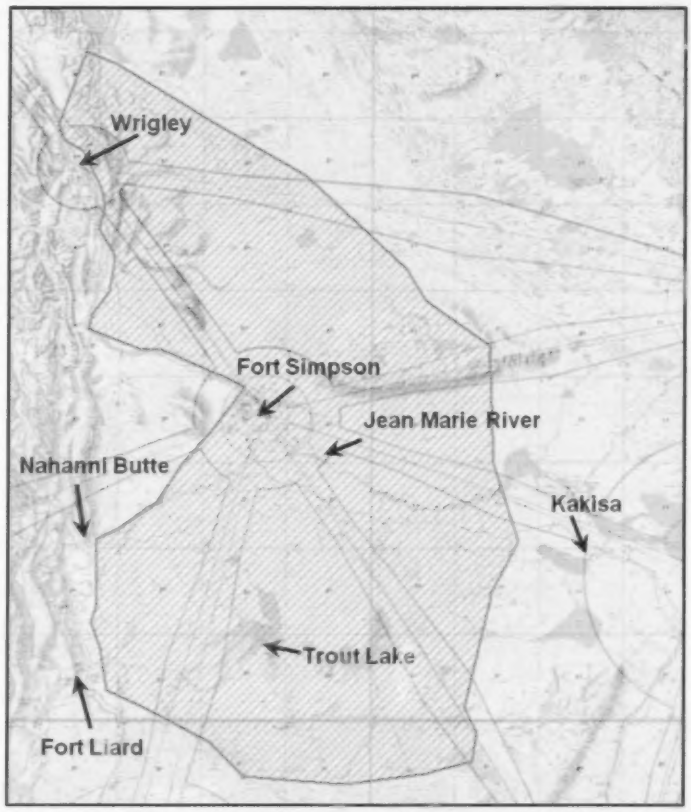


Figure 1. The Dehcho boreal caribou study area, based upon the locations of satellite/GPS collared adult female boreal caribou.

Home Ranges

We calculated the 100% minimum convex polygon (MCP) for all caribou with satellite (DS) or GPS collars that had provided locations for ≥12 months (n=82). The MCP is a line connecting all of the outside points where a specific caribou was located and represents the range used by that individual female caribou. For 48 of the 82 collared females we had locations for ≥24 months. We used all locations to calculate a cumulative range used by each individual female (Figure 2). The mean range size was 2989.34km^2 (range 260.6-14,419.9km^2; median 2327.72km^2). Seven caribou have been located in northeastern British Columbia (NEBC) and one in northwestern Alberta (Figure 2). Six caribou collared in an NEBC study have been located southeast of Trout Lake (Brad Culling pers. comm.). A caribou originally collared in the adjacent Cameron Hills study area (Johnson 2007), was re-captured and collared in February 2007 near Trainor Lake; this collar released in June 2010. We calculated its home range based solely on locations after it was re-collared. A caribou collared north of Trout Lake in February 2010 has the largest range. She moved south of Trout Lake, east towards the Redknife River, and more recently west towards the Netla River and the Liard Highway. Home range sizes we report are similar to those reported for the Cameron Hills and Hay River Lowlands (Kelly and Cox 2011) and Gwich'in study areas (means of *ca.* 3000km^2; Nagy 2011).

Figure 2. Cumulative ranges (100% MCP) of 82 collared female boreal caribou. Red, females with ARGOS DS collars, black, females with ARGOS GPS collars, and purple, female with Vectronic Iridium GPS collar.

Calving and Calving Events

Female boreal caribou spread out during the calving period, likely to avoid predation (Figure 3). Daily movement rates drop dramatically from *ca.* 6km/day two days prior to calving, to *ca.* 0.2km/day on the day of calving, and remain at ≤1km/day for about a week post-calving (Nagy 2011). By analyzing the daily movement patterns of collared female caribou we can determine when and where a female boreal caribou calved or not. Peak of the calving period for boreal caribou in the southern NWT is May 7-21 (Nagy 2011). By using movement data to determine calving dates, we no longer have to fly survey(s) during the calving period thus reducing disturbance and we also get a more accurate assessment of the number of calves born because we do not risk surveying before calves are born or after newborn calves may have died.

Figure 3. Calving locations of collared boreal caribou • during 8-29 May, 2013. Note the wide dispersal throughout the range.

We determined all potential calving events, based upon movement data, for all collared caribou from 2004 to 2013 where there was location data from 1 May to 1 June. Of the 235 potential calving events, from 100 different females, only two potential calving events could not be determined by the analysis of movement data. There were 220 (93.6%) births and 13 instances when a caribou did not give birth. This finding is consistent with the high level of pregnancy of captured females based upon serum progesterone (92.0%) (Table 1). The high number of births and pregnancies from collared females implies that capture and wearing a collar has not prevented females from becoming pregnant and bearing calves.

In 2013, 31 of 33 females (94%) had calves, based upon the analysis of daily movements; four of the 31 lost their calves shortly after birth. Calves were born over an extended period from May 8-29, 2013. Only in 2008 was the length of the calving period >22 days. More calves were born later in the calving

period in 2013 than on average. On 9 May the most calves were born (n=5) but it was not until 18 May that over 50% of the calves had been born (Figure 4).

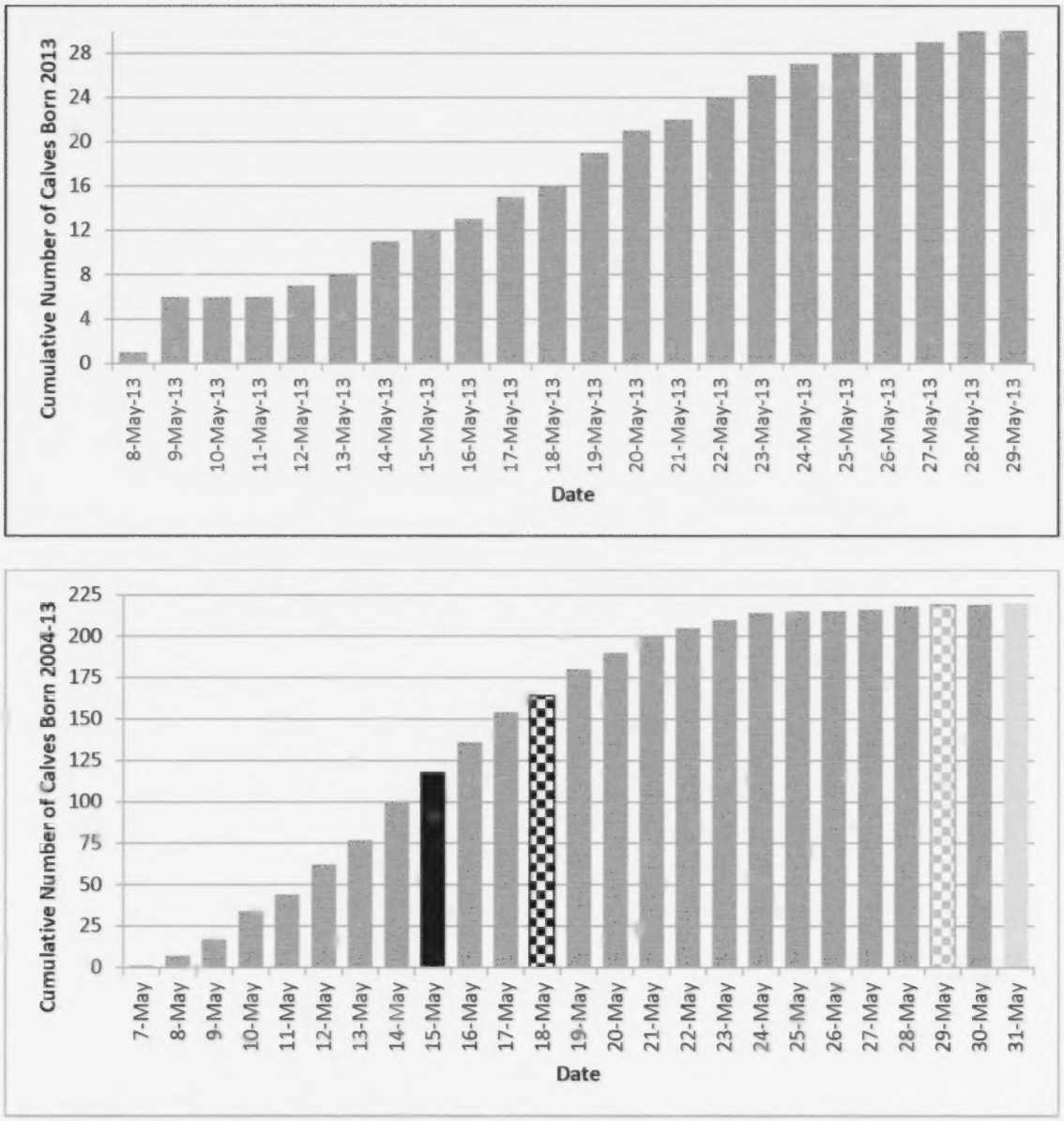


Figure 4. Top - The number of calves born, on successive days to 31 collared female boreal caribou during the May, 2013 calving period. Bottom - The number of calves born on successive days pooled over 10 calving periods. The solid black histobar indicates average date when 50% calves born; the solid green histobar indicates the latest date a single calf was born on; the hashed histobars represent the 2013 dates for 50% born and final calf born.

Timing and Fidelity of Calving

Individual females had remarkable consistency in calving dates. Twenty-three different females had calves each year for four consecutive years. Two of these females had three of four calves born on the same date; another four females had all of their calves born within a 4-day period each year. One female collared in February 2010 had calves on the same day in 2010, 2011, and 2012, unfortunately she died in summer 2013. Since the 2007 calving season there has generally been a minimum of 20 calving events. In five of those seven years >5 caribou calves were born on the same day.

Whether or not collared caribou show fidelity to calving location is a topic of great debate. From this study we know that female caribou can live to 17 years, have a calf as early as two years and as late as 16 years, and have an average range of *ca.* 3000km^2. We have locations of four consecutive calving events for 23 different females. Although this is only four of a potential maximum 15 calving events in a lifetime, fidelity to an area for calving for a 3-4 year period may have implications related to disturbance mitigation. We measured the distance between each successive and all calving events for the 23 females that calved for four successive years. Some females calved in the same general area while others did not. Eight females had successive calving locations <1300m distant; three females <300m distant. The average distance between four calving locations for one female was <500m. The average distance between four calving locations for four females was <6km. Contrastingly, the average distance between four calving locations was >30km for five other females.

Calf Survival

This year we had a reduced number of collared females that calved in May 2013 and survived through March 2014, from which to estimate calf survival. Collars released on schedule from five females and an additional five females died. Of the remaining 17 collared females that calved in May 2013, and survived with active collars to March 2014, only five were observed with calves in the classification survey; 29% calf survival.

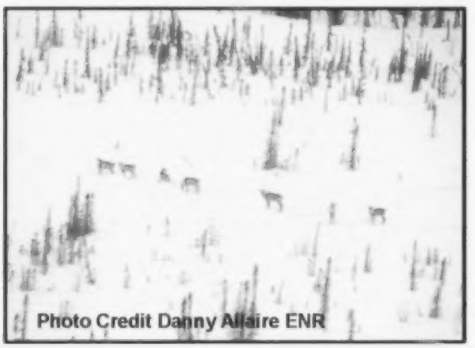
Based upon movement data we suspect that at least three females had calves that did not survive more than a week after birth and a fourth lost her calf at one month of age. We have not this many neonatal deaths since the first years of the study. This year calves were born over an extended period (Figure 4) and according to local harvesters the spring was colder and had extended snow coverage which could have impacted neonates. During winter 2013-14 the southern portion of the Dehcho region experienced abnormal warming events (to the mid-teens °C), and bouts of freezing rain on snow which may also have affected calf survival this year.

Boreal caribou, like other deer, have a high probability of conceiving after reaching maturity at 2-3 years old. Based upon the level of progesterone in blood serum from the collared females, 92% (115 of 125) were pregnant; six (5.0%) were not pregnant and the remaining four were borderline (Table 1).

Table 1. The number of blood samples indicating pregnant, borderline, and not pregnant for collared boreal caribou females over time. Pregnancy determination based upon progesterone levels in blood serum. No collaring occurred in 2011.

	2004	2005	2006	2007	2008	2009	2010	2012	2013	2014
Pregnant	10	12	10	16	7	7	17	14	10	12
Borderline	0	0	2	1	0	0	1	0	0	0
Not Pregnant	0	1	1	0	1	1	0	2	0	0
Total	10	13	13	17	8	8	18	16	10	12

February/March Classification Survey



This survey is conducted with a helicopter because we need to see all collared caribou and determine the sex/age class of all other caribou we see. Caribou are classified into calves (9-10 months old), yearlings (21-22 months old), females (≥32 months old), and males (≥32 months old), based upon antler size and shape, and animal size. There is the potential for some yearlings to be mistakenly classified as females or males ≥32 months old. Photographs of caribou groups are taken to verify classification and the presence of calves. We assume that calves of the year observed in this late winter survey are recruited into the population. We also report other wildlife observed during surveys (Table 2). We flew the survey 3-5 March, 2014, covering a flight line of *ca.* 1787km; 196 boreal caribou were seen and classified (Table 2).

Movement data showed that caribou did not become sedentary for extended periods of January and February as in most other years. Local harvesters attributed this to the lack of snow so caribou and wolves could easily move around. We certainly observed many areas of cratering throughout the study area when conducting the classification survey. This year caribou were in smaller groups than in other years. We saw only two groups of ≥10 caribou, the largest group being 16, and the average number of caribou grouped with a collared caribou was the second lowest recorded at 6.5.

Five of 32 collared females were observed with calves. Based upon the total number of females and calves observed during the survey, we estimated 27.4 calves per 100 adult females this March. This is lower than the estimate for each of the previous five years (Table 2), and similar to that reported for caribou in the Cameron Hills and Hay River Lowlands study areas (Kelly and Cox 2011) but lower than that reported for the Gwich'in study areas in the Lower Mackenzie Valley (J. Nagy pers. comm.). Wolf predation on boreal caribou is negligible in the Lower Mackenzie Valley unlike in the Cameron Hills, Hay River Lowlands and Dehcho study areas (Johnson 2007; Larter and Allaire 2010; Kelly and Cox 2011; Nagy 2011).

Table 2. The total number of caribou classified, and other wildlife observed, during the sex/age classification surveys in 2006-2014 conducted in February-March.

	2006	2007	2008	2009	2010	2011	2012	2013	2014
#of active collars	24	33	35	37	39[1]	24[2]	30	35[2]	32[2]
Total # of caribou observed	170	216	241	291	235	161	197	282	196
# of females (≥32 mo.)	94	114	145	160	128	74	104	153	106
# of calves (8-10 mo.)	27	26	34	50	45	33	40	43	29
# of yearlings (20-22 mo.)	13	6	1	1	1	2	1	2	1
# of males (≥32 mo.)	35	70	61	80	61	50	52	84	59
# unknown sex/age caribou	1	0	0	0	0	2	0	0	1
# of calves per 100 females	28.7	22.8	23.4	31.3	35.2	44.6	38.5	28.1	27.4
# of moose observed	18	38	15	31	23	22	25	18	23
# of wolves observed	2	1	0	0	0	0	0	0	2
Flight line length (km)	1200	1600	1700	2000	1750	1655	1900	1865	1787

[1] One collared animal located during the South Slave classification survey.
[2] Two collared animals located during the South Slave classification survey.

For a second year a similar sex/age classification survey was conducted in the adjacent South Slave study area. Caribou collared as part of this Dehcho study were collared and have been located in South Slave study area. Collared caribou move back and forth across the arbitrary boundary. This year we relocated one animal from the South Slave study and two animals from the Dehcho study were relocated during the South Slave survey (Table 2). Six caribou collared in northeastern British Columbia were located in an area south of Trainor Lake to the NT/BC border during March (Brad Culling pers. comm.).

Released Collars and Caribou Deaths

Starting in March 2005, release mechanisms became standard on all collars deployed. The programmed release dates are usually between mid-June to mid-July, shortly after the calving period. The VHF is duty cycled so that it transmits signals for potentially up to six months after the collar has released, giving us a better chance of retrieving the collar. This year five collars released (169, 174, 177, 184, 186); all released on schedule on 15 June 2013. We were able to retrieve three of these collars; one collar is not retrievable. Collar 177 released in an area that burnt last summer, only the brass housing remained (Appendix 2). To date 34 collars have released with 11 being retrieved.

We retrieved collars from the three collared caribou that died between June 27, 2013 and July 14, 2013 (caribou 188, 198, 208) and one that died in 2011 (caribou 185). A local trapper returned a collar from a caribou (192) killed by wolves adjacent to his trapline (see Appendix 2 for details). Retrieved collars are refurbished if possible.

Since March 2004, 57 collared caribou have died. Predation has been the main cause of death. There is strong evidence that 35 caribou (61%) were killed by wolves and one was killed by a black bear. Six (10%) caribou were harvested and, four died of causes likely associated with malnutrition. Six death sites we were unable to visit and the VHF

are no longer transmitting. Five death sites from the past year were not visited but the VHF will continue to transmit through next summer. Generally, deaths occur between late-March and mid-July in any year (n=38; 67%); similar to that reported in the Cameron Hills and Hay River Lowlands study areas (Johnson 2007).

Seismic lines allow wolves greater access to caribou habitat (Neufeld 2006). This access has resulted in more caribou mortalities in many areas (McLoughlin *et al.* 2003). In Northwest Territories boreal caribou use areas ≤400m from anthropogenic linear features less than other areas, and travel faster when they encounter them (Nagy 2011). The remains of 14 of 35 (40%) caribou preyed upon by wolves ≤400m from anthropogenic linear features. Data for linear features are based upon the Northwest Territories Dehcho Land Use Planning Board.

We retrieved teeth from four caribou this year. We now have age at death for 20 of the 57 caribou that have died during the study. The age at death is determined by counting stained cementum annuli on teeth (preferably the incisor), similar to counting the rings of a tree (Figure 6). June 1 has historically been used as the birth date for caribou (Matson 1981). Age at death for female boreal caribou in our study area ranged from four to 17 years (mean and median 10.5 years; Figure 6).

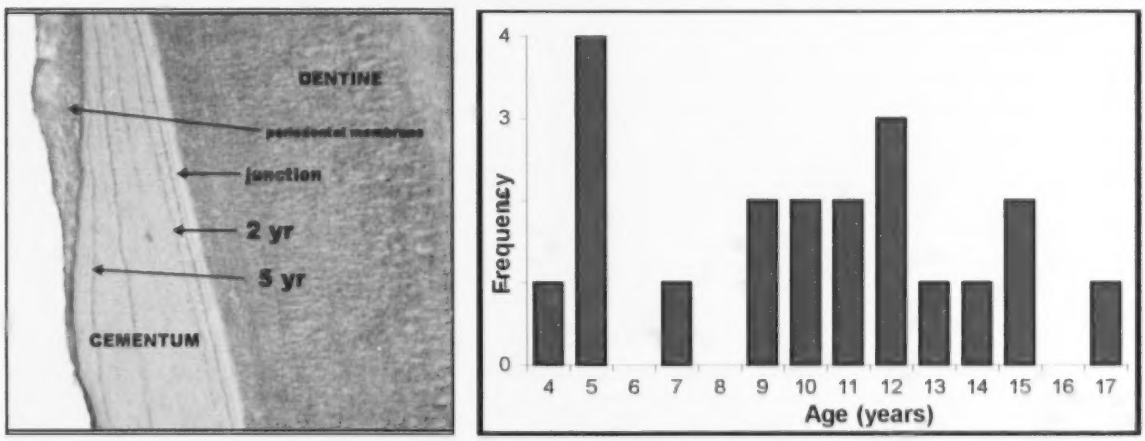


Figure 6. Left - The stained section of a tooth root. The dark blue lines are stained cementum; Right - The frequency of age at death for 20 female boreal caribou. Age was determined by counting cementum annuli.

Adult Female Survival

Annual adult female survival of collared females was determined following Kaplan and Meier (1958) and Pollock et al. (1989). Our best estimate (geometric mean) of adult female survival over the past nine years is 78% (Table 3). For 2013-14 we report the second lowest annual female survival (68%). Only during 2005-06 was survival lower and for the past five years average female survival was >80% (Table 3; Figure 7). We did not include the estimates from 2004-05 due to a small sample size (ten collars) and the restricted area of deployment. Adult females collared in the north Dehcho have a

Table 3. The estimated annual population rate of increase (λ) for nine successive years. Rates for the south Dehcho are calculated for caribou collared south of the Mackenzie River, rates for the north Dehcho for caribou collared north of the Mackenzie River.

South Dehcho

Year	Female Survival Rate	Calf:100 Females	Rate of Increase (λ)
2005-2006	0.6250	0.2587	0.7179
2006-2007	0.6429	0.2616	0.7396
2007-2008	0.9375	0.2558	1.0750
2008-2009	0.7391	0.4444	0.9503
2009-2010	0.8500	0.4667	1.1087
2010-2011	0.7143	0.5555	0.9890
2011-2012	0.8750	0.2443	0.9968
2012-2013	0.9231	0.5555	1.2781
2013-2014	0.6429	0.2000	0.7143

North Dehcho

Year	Female Survival Rate	Calf:100 Females	Rate of Increase (λ)
2005-2006	0.6000	0.3318	0.7193
2006-2007	0.7500	0.1999	0.8333
2007-2008	0.8235	0.1937	0.9118
2008-2009	1.0000	0.3333	1.2000
2009-2010	0.8235	0.6667	1.2353
2010-2011	1.0000	0.7333	1.5789
2011-2012	0.7692	0.6250	1.1189
2012-2013	0.8462	0.0588	0.8718
2013-2014	0.7143	0.1333	0.7653

Dehcho Combined

Year	Female Survival Rate	Calf:100 Females	Rate of Increase (λ)
2005-2006	0.6191	0.2881	0.7232
2006-2007	0.6923	0.2286	0.7817
2007-2008	0.8788	0.2335	0.9949
2008-2009	0.8000	0.3611	0.9763
2009-2010	0.8378	0.5238	1.1351
2010-2011	0.8571	0.6667	1.2857
2011-2012	0.8095	0.4333	1.0334
2012-2013	0.8846	0.3143	1.0496
2013-2014	0.6786	0.1667	0.7403

somewhat higher estimated survival than females collared in the south Dehcho, 80.5% versus 76.3% (geometric means over 9 years). Nagy (2011) found that boreal caribou populations were more viable in areas with fewer seismic lines, and where there were larger patches of secure unburned habitat. Our estimates of adult female survival support this because there are fewer seismic lines, and more, larger patches of unburned habitat in the north versus the south Dehcho. The adult female survival rate we report is similar to estimates from studies in the Cameron Hills (81% average from five years; Kelly and Cox 2011). Mean female survival we report is lower than estimated in the Hay River Lowlands (86% average from seven years; Kelly and Cox 2011), and Gwich'in (≥95% average from three years; Nagy 2011) areas, and for most populations in Alberta (range 78-91%; Hervieux et al. 2013). Low adult female survival reduces the population rate of increase.

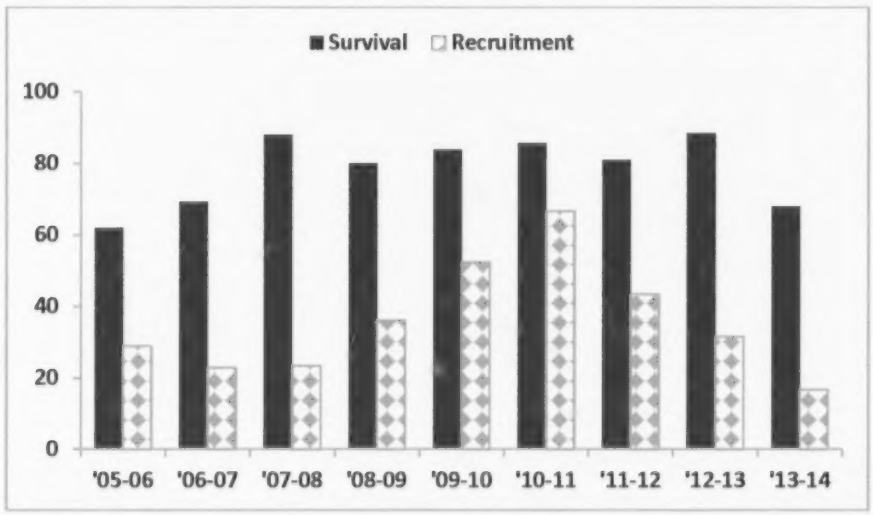


Figure 7. Adult female survival (%) and calves:100 adult females in March (recruitment) for the Dehcho study area from 2005-06 to 2013-2014, based on radio-collared female caribou.

Estimated Population Rate of Increase

We estimated the population rate of increase (λ) measured from April 1 to March 31 for nine successive years for all caribou collared throughout the entire study area. We made separate estimates for caribou collared north and south of the Mackenzie River (Table 3). We based the λ estimate on annual female survival and the ratio of calves per 100 adult females (calf:cow) reported in March (Hatter and Bergerud 1991). Of note is that prior to 2009, the March ratio of calf:cow was estimated from all animals observed during the classification surveys. From 2009 to present, we had a larger sample size of collared and therefore known females. Because it is collared females that are used to estimate adult survival, and adult females are harvested, we estimated calf:cow solely from the collared females. We feel this is the most appropriate estimation of recruitment assuming that the collared females are a representative sample of all females. A rate of

increase, or λ, of one indicates population stability, <1 indicates population decrease, and >1 indicates population increase. Small sample sizes affect the confidence of the estimate. The higher estimated annual rates of increase from 2008-09 to 2012-13 have been encouraging, but the average estimated rate of increase over the past nine years (λ = 0.95) still remains <1. If we had started with a population of 1000 adult female caribou in 2004, and used our estimated annual population rates of increase there would be 648 adult females today (Figure 8). Figure 8 also demonstrates how one year with lower adult female survival combined with lower recruitment can have a major impact on population rates of increase.

The population rate of increase (λ) we report (averaged over nine years) is similar to the Hay River Lowlands (λ = 0.96 averaged over seven years) but greater than the Cameron Hills (λ = 0.87 averaged over five years) study areas, (Kelly and Cox 2011) and greater than most boreal caribou populations in Alberta (Hervieux et al. 2013). Adult female survival is higher in both South Slave (SS) study areas and most populations in Alberta. Calf recruitment in SS study areas and most populations in Alberta is much lower than in the Dehcho. Low calf recruitment appears to be reducing λ in the SS study areas and in Alberta boreal caribou populations regardless of >80% adult female survival. The population rate of increase reported for the Gwich'in areas over two to three years was λ = 1.08 to 1.20 (Nagy 2011). In the Gwich'in area both female survival and late winter calf:cow are higher.

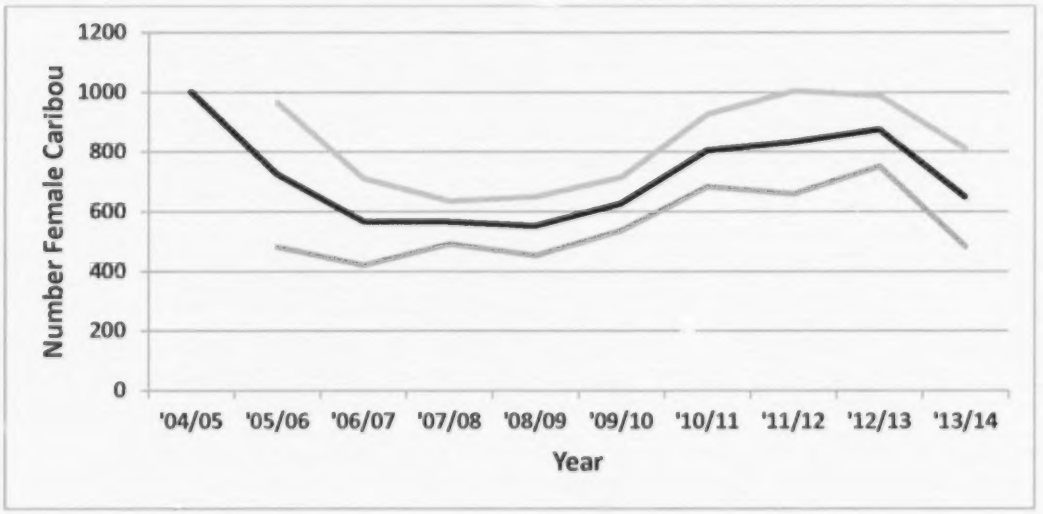


Figure 8. The estimated number of female caribou in each year of the study starting with a population of 1000 and using the annual rates of increase (λ) calculated for the 9 successive years. The green and red lines represent the upper and lower 95% confidence intervals.

2013-14 a "bad year"

Summer (June-July) mortalities of female boreal caribou have been rare. This year we had four. Higher summer mortalities were also reported in the adjacent Hay River lowlands study area (Allicia Kelly pers. comm.) and in northeastern British Columbia (NEBC) (Diane Culling pers comm.). A vast majority of the reported summer deaths were cases of non-predation deaths where it appeared as though the caribou had just laid down and died (Figure 9). In NEBC there were 17 reported such cases between March and August 2013 (Diane Culling pers comm.). In the Hay River Lowlands there were 5 reported cases. Four of these carcasses were visited shortly after death and intact long bone samples, hair and teeth were collected and forwarded to the Canadian Cooperative Wildlife Health Centre CCWHC lab in Saskatoon. Starvation was diagnosed as the cause of death for these animals (Allicia Kelly pers. comm.). Two of our collared caribou deaths in late-June 2013 were non-predation deaths.

Figure 9. The "curled up" carcass of a female boreal caribou that we suspect died of malnutrition in June 2014.

We were unable to visit these mortality sites until 11 September because aircraft were in use fighting forest fires in the region. When we were able to visit the mortality sites we retrieved the collars and found both carcasses were intact skin and bone racks that appeared to have curled up and died (Figure 8). Samples to diagnose death were unavailable but we collected teeth. These two females were aged 12 and 13, older than average death date (Figure 6). We suspect that these females starved leaving nothing of interest for scavengers to disarticulate the carcass for. Only once before have we seen something similar that was a collared caribou that died on 5 July 2006. A third summer mortality site we visited showed evidence of predation. We were unable to visit the fourth summer mortality site.

Similar to the NEBC study we found fewer calves during the March 2014 classification surveys and hence lower recruitment than in previous years. The combination of higher than average adult mortality and lower than average calf recruitment this past year certainly impacted the population rate of increase. The gains made by increasing λ's over the past four years have been negated with this one year (Figure 8).

Disease and Parasites

Baseline data collected from the Dehcho, and South Slave study areas from 2003-2007 indicated that boreal caribou were relatively disease and parasite free. Low numbers of parasites and antibodies to disease were reported; none were a cause for concern. All 22 blood samples submitted for *Brucella* testing were negative. More details can be found in Johnson *et al.* (2010). Fecal samples from 12 collared females in February 2014 showed a low incidence (4 of 12) of common parasites. One caribou captured in the Hay River Lowlands in March, 2013 had the first reported case of winter ticks (Allicia Kelly pers. comm.).

Present and Future of the Study

We continue to work co-operatively with other researchers conducting boreal caribou studies. Nic Larter is a member of the Dehcho Boreal Caribou Working Group. Data from this study have been incorporated into a territorial-wide analysis. Data from this study are being used in a Master's program at the University of Alberta and are being used for the development of boreal caribou range plans. Continued monitoring of the Dehcho boreal caribou program using collars has been endorsed by the Dehcho Boreal Caribou Working Group.

Five collars released on schedule this past year, no collars are scheduled to release during the next year. We make every attempt to retrieve collars so they can be refurbished for future deployment. We continue to use Telonics DS or GPS ARGOS collars almost exclusively with great success. New collar purchases in the near future would be GPS ARGOS. There continues to be support from our First Nations partners for annual deployment of collars to maintain a minimum of 30 active collars on females during the calving period throughout the study area. We also have received multi-year funding support.

Deliverables

ENR provides this annual progress report on the Dehcho boreal caribou study to its First Nations partners and to the Western Northwest Territories Biophysical Study. The report is posted on the ENR website. ENR continues to provide quarterly maps to its First Nations partners. The maps show the ranges used by each individual collared female caribou over the previous three months.

Presentations were made to the Dehcho Boreal Caribou Working Group. A poster presentation of this program will be made at the 15th North American Caribou Workshop in Whitehorse in May. Program results will be presented at the 7th biannual Dehcho regional wildlife workshop, in Fort Simpson, in October.

Acknowledgements
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Dr. John Nagy provided comment on and assistance with data analysis, stimulating discussions, and data/results from other analyses of boreal caribou location data. We wish him a speedy recovery from a recent medical condition. Allicia Kelly and Karl Cox provided comparative data from the South Slave region. Brad and Diane Culling provided comparative data from northeastern British Columbia. Forest Management, ENR, Fort Simpson, provided access to helicopter fuel for collar retrievals, deployment and the March survey. CLS America and Vectronics Aerospace provide satellite location data. Telonics provided GPS collars. Matson's Lab aged caribou teeth. Great Slave Helicopters provided aircraft and skillful piloting for collar retrievals and the March survey. Diversified Environmental deployed collars. The Dehcho Land Use Planning Board provided digital linear feature data. Funding for the past year came from Wildlife Division, ENR, the Western Northwest Territories Biophysical Study (GNWT) and Aboriginal Affairs and Northern Development Canada.

Personal Communications
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References

Hatter I.W. and A.T. Bergerud. 1991. Moose recruitment, adult mortality and rate of change. Alces 27: 65-73.

Hervieux, D., M. Hebblewhite, N.J. DeCesare, M. Russell, K. Smith, S. Robertson and S. Boutin. 2013. Widespread declines in woodland caribou (*Rangifer tarandus caribou*) continue in Alberta. Canadian Journal of Zoology 91: 872-882.

Johnson D. 2007. Boreal caribou fitness and habitat use in the Bistcho Lake/Cameron Hills area of the Dehcho, NWT – 1 April 2006 – 30 March 2007.

Johnson D, N.J. Harms, N.C. Larter, B.T. Elkin, H. Tabel, and G. Wei. 2010. Serum biochemistry, serology and parasitology of boreal caribou (*Rangifer tarandus caribou*) in the Northwest Territories, Canada. Journal of Wildlife Diseases 46: 1096-1107.

Kaplan E.L. and P. Meier. 1958. Nonparametric estimation from incomplete observations. Journal of American Statistical Association 53: 457-481.

Kelly A. and K. Cox. 2011. Boreal caribou progress report: Hay River Lowlands and Cameron Hills study areas 1 April 2008 – 31 March 2010. ENR Fort Smith.

Larter N.C. and D.G. Allaire. 2009. Dehcho boreal caribou study progress report, April 2009. ENR Fort Simpson.

Larter N.C. and D.G. Allaire. 2010. Dehcho boreal caribou study progress report, April 2010. ENR Fort Simpson.

Matson G.M. 1981. Workbook for cementum analysis. Milltown, MT.

McLoughlin P.D., E. Dzus, B. Wynes and S. Boutin. 2003. Declines in populations of woodland caribou. Journal of Wildlife Management 67: 755-761.

Nagy J.A. 2011. Use of space by caribou in northern Canada. PhD thesis, University of Alberta. Edmonton, AB. 164pp.

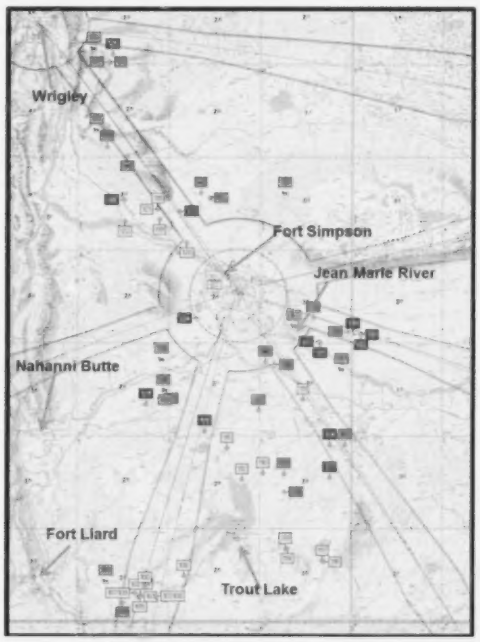
Nagy J.A., D.L. Johnson, N.C. Larter, M.W. Campbell, A.E. Derocher, A. Kelly, M. Dumond, D. Allaire, and B. Croft. 2011. Subpopulation structure of caribou (*Rangifer tarandus L.*) in arctic and subarctic Canada. Ecological Applications 21: 2334-2348.

Neufeld L.M. 2006. Spatial dynamics of wolves and woodland caribou in an industrial forest landscape. MSc dissertation, University of Alberta. Edmonton, AB. 155pp.

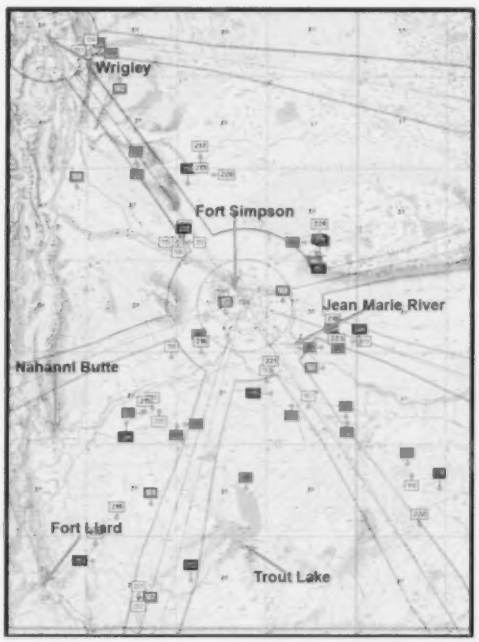
Pollock K.H., S.R. Winterstein, C.M. Bunck and P.D. Curtis. 1989. Survival analysis in telemetry studies: the staggered entry design.

Appendix 1. The number and type of collars deployed on adult females throughout the course of the study (Table) and deployment locations for each year (Figures).

Date caribou collared	Satellite (ST-20-3610 or TAW-4610H)	GPS (TGW-3680 or TGW-4680)	VHF (Mod 600)	Vectronic GPS-PLUS 2	Totals
March 2004	10				10
March 2005	13				13
January 2006	9		4		13
January 2007	8	9			17
February 2008	4	4			8
February 2009	1	7			8
February 2010	9	9			18
February 2012	2	14			16
February 2013	1	8		1	10
February 2014		12			
TOTAL	57	63	4	1	125



Locations of 61 female boreal caribou collared in 2004, 2005, 2006, 2007, 2008 (see colour for locations).



Locations of 64 female boreal caribou collared in 2009, 2010, 2012, **2013,** 2014 (see colour for locations).

Appendix 2. Collar retrievals conducted from September 2013 to January 2014.

All collar retrievals from dead animals.

- 11 September, helicopter south of the Mackenzie Highway, retrieved collar from caribou 185 south of Cormack Lake; predation related.
- 11 September, helicopter to Big Island Lake and south of the Mackenzie Highway and Redknife River, retrieved collars from caribou 188 and 208; both malnutrition related.
- 21 October, helicopter to south of Antoine Lake, retrieved collar from caribou 198; predation related.
- 14 January, trapper retrieved collar from caribou 192; caribou killed by wolves adjacent to trapline.

All flights to retrieve released collars.

- 11 September, helicopter to Cap Mountain; retrieved collar from caribou 174.
- 11 September, helicopter south of Mackenzie highway, retrieved collar from caribou 177 south of Sambaa Deh Territorial Park and retrieved collar from caribou 186 north of Cormack Lake.

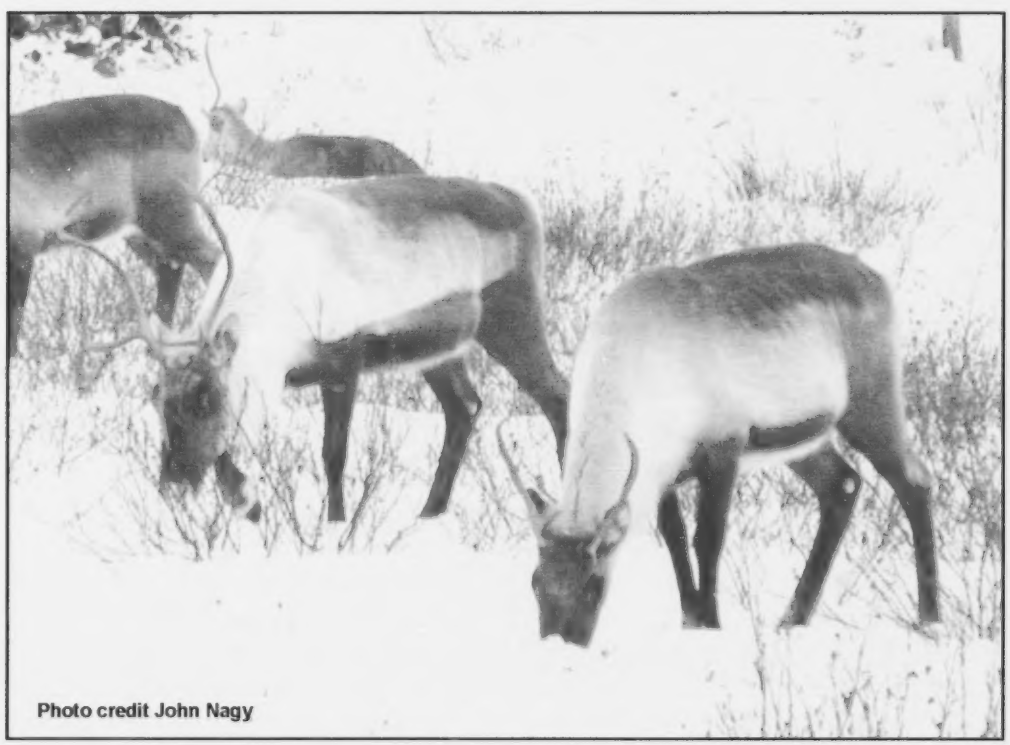


Photo credit John Nagy

Appendix 3. A timeline of each collared caribou since 2004. The collar type (GPS, Sat = Satellite, VHF) is noted as well as whether most recently only VHF signals are being received. **Black** font indicates currently active collars on caribou. Blue font indicates released caribou collars. Green font indicates unknown status/no release mechanisms on caribou collars. Red font indicates collars of known dead caribou. Yellow font indicates collars of known dead caribou where death was related to malnutrition. **Purple** indicates collars of known harvested caribou.

Caribou #224 (GPS)
- 10 Feb/14 collared
- Unable to relocate 3 Mar/14, GPS didn't initialize properly during deployment
- Received transmissions in April

Caribou #223 (GPS)
- 10 Feb/14 collared
- 5 Mar/14 seen in group of 2 with #206 without calf

Caribou #222 (GPS)
- 8 Feb/14 collared
- 5 Mar/14 seen in group of 3 without calf

Caribou #221 (GPS)
- 8 Feb/14 collared
- 4 Mar/14 seen in group of 2 without calf

Caribou #220 (GPS)
- 8 Feb/14 collared
- 3 Mar/14 seen in group of 3 without calf

Caribou #219 (GPS)
- 8 Feb/14 collared
- 3 Mar/14 seen in group of 5 without calf

Caribou #218 (GPS)
- 7 Feb/14 collared
- 5 Mar/14 seen in group of 5 without calf

Caribou #217 (GPS)
- 7 Feb/14 collared
- 3 Mar/14 seen in group of 4 without calf

Caribou #216 (GPS)
- 6 Feb/14 collared
- 3 Mar/14 seen in group of 12 without calf

Caribou #215 (GPS)
- 6 Feb/14 collared
- 4 Mar/14 seen in group of 9 with #204 without calf

Caribou #214 (GPS)
- 6 Feb/14 collared
- 4 Mar/14 seen in group of 6 with #202 without calf

Caribou #213 (GPS)
- 6 Feb/14 collared
- 4 Mar/14 seen in group of 3 without calf

Caribou #212 (GPS)
- 27 Feb/13 collared
- 5 Mar/13 seen in group of 7 with calf
- 4 Mar/14 seen in group of 5 without calf

Caribou #211 (Sat)
- 14 Feb/13 collared
- 6 Mar/13 seen in group of 5 with calf
- 5 Mar/14 seen in group of 6 without calf

Caribou #210 (GPS)
- 12 Feb/13 collared
- 4 Mar/13 seen in group of 16

without calf
- 3 Mar/14 seen alone without calf

Caribou #209 (GPS-PLUS 2)
- 12 Feb/13 collared
- 4 Mar/13 seen in group of 6 with #196 without calf
- 3 Mar/14 seen in group of 2 with calf

Caribou #208 (GPS, died, non-predation)
- 12 Feb/13 collared
- 5 Mar/13 seen in group of 8 without calf
- Died 30 June/13, death related to malnutrition
- 11 Sept/13 collar retrieved

Caribou #207 (GPS, died)
- 12 Feb/13 collared
- 4 Mar/13 seen alone without calf
- Died 15 Nov/13

Caribou #206 (GPS)
- 12 Feb/13 collared
- 5 Mar/13 seen in group of 4 without calf
- 5 Mar/14 seen in group of 2 with #223 without calf

Caribou #205 (GPS, died)
- 11 Feb/13 collared
- 5 Mar/13 seen in group of 5 without calf
- Died 30 June/13

Caribou #204 (GPS)
- 11 Feb/13 collared
- 5 Mar/13 seen in group of 10 with #169, #170 with calf
- 4 Mar/14 seen in group of 9 with #215 with calf

Caribou #203 (GPS)
- 11 Feb/13 collared
- 5 Mar/13 seen in group of 7 without calf
- 4 Mar/14 seen in group of 7 with calf

Caribou #202 (GPS)
- 14 Mar/12 collared
- Did not relocate in 2012, was collared after survey
- 5 Mar/13 seen in group of 6 without calf
- 4 Mar/14 seen in group of 6 with #214 without calf

Caribou #201 (GPS)
- 14 Mar/12 collared
- Did not relocate in 2012, was collared after survey
- 5 Mar/13 seen in group of 11 without calf
- 4 Mar/14 seen in group of 6 with calf

Caribou #200 (GPS)
- 17 Feb/12 collared
- 2 Mar/12 seen with #199 but without calf
- 5 Mar/13 seen in group of 4 with calf
- 4 Mar/14 seen alone without calf

Caribou #199 (Sat)
- 17 Feb/12 collared
- 2 Mar/12 seen with #200 but without calf
- 5 Mar/13 seen in group of 13 without calf
- 4 Mar/14 seen in group of 4 without calf

Caribou #198 (GPS, died)
- 17 Feb/12 collared
- 2 Mar/12 seen in group of 4 without calf

- 5 Mar/13 seen in group of 13 with calf
- Died 14 July/13
- 21 Oct/13 collar retrieved

Caribou #197 (GPS)

- 17 Feb/12 collared
- 1 Mar/12 seen in group of 6 without calf
- 5 Mar/13 seen in group of 2 with calf
- 4 Mar/14 seen alone without calf

Caribou #196 (GPS)

- 16 Feb/12 collared
- 29 Feb/12 seen in group of 4 with calf
- 4 Mar/13 seen in group of 6 with #209 without calf
- 3 Mar/14 seen in group of 2 with calf

Caribou #195 (GPS)

- 16 Feb/12 collared
- 29 Feb/12 seen in group of 7 without calf
- 4 Mar/13 seen in group of 4 without calf
- 3 Mar/14 seen in group of 8 without calf

Caribou #194 (Sat, died)

- 16 Feb/12 collared
- 29 Feb/12 seen in group of 4 without calf
- 4 Mar/13 seen in group of 3 without calf
- Died 20-22 Dec/13

Caribou #193 (GPS)

- 16 Feb/12 collared
- 29 Feb/12 seen in group of 7 with calf
- 4 Mar/13 seen in group of 4 without calf
- 3 Mar/14 seen in group of 5 without calf

Caribou #192 (GPS, died)

- 16 Feb/12 collared
- 29 Feb/12 seen alone
- 4 Mar/13 seen in group of 5 without calf
- Died 11 Jan/14
- 14 Jan/14 collar retrieved by trapper

Caribou #191 (GPS)

- 15 Feb/12 collared
- 29 Feb/12 seen in group of 4 with calf
- 4 Mar/13 seen in group of 5 without calf
- 3 Mar/14 seen in group of 7 without calf

Caribou #190 (GPS, died)

- 15 Feb/12 collared
- 29 Feb/12 seen in group of 3 with calf
- Died 25 Mar/12
- 19 June/13 collar retrieved

Caribou #189 (GPS, VHF only)

- 15 Feb/12 collared
- 1 Mar/12 could not relocate in area
- 15 Mar/12 relocated in fixed-wing weak VHF signal
- 21 June/12 no satellite locations

Caribou #188 (GPS, died, non-predation)

- 15 Feb/12 collared
- 1 Mar/12 seen in group of 3 without calf
- 6 Mar/13 seen in group of 3 with #151.790 without calf
- Died 27 June/13, death related to malnutrition
- 11 Sept/13 collar retrieved

Caribou #187 (GPS, died)

- 15 Feb/12 collared

- 1 Mar/12 seen in group of 4 without calf
- 6 Mar/13 seen in group of 4 with #151.980 without calf
- Died 10 July/13

Caribou #186 (GPS, released)
- 27 Feb/10 collared
- 2 Mar/10 seen with calf
- 2 Mar/11 seen in group of 5 with calf
- 2 Mar/12 seen in group of 4 with calf
- 5 Mar/13 seen in group of 13 without calf
- 15 June/13 released
- 11 Sept/13 collar retrieved

Caribou #185 (GPS, died)
- 27 Feb/10 collared
- 2 Mar/10 seen alone, collar is resetting
- 3 Aug/10 located, no visual
- 2 Mar/11 seen in group of 4 with calf
- Died 22 Apr/11
- 24 Aug/12 unsuccessful retrieval attempt
- 11 Sept/13 collar retrieved

Caribou #184 (GPS, released)
- 26 Feb/10 collared
- 1 Mar/10 seen in group of 6 with calf
- 1 Mar/11 seen in group of 7 with calf
- 1 Mar/12 seen in group of 4 with calf
- 4 Mar/13 seen in group of 4 without calf
- 15 June/13 released

Caribou #183 (Sat)
- 26 Feb/10 collared
- 1 Mar/10 seen in group of 6 without calf
- 1 Mar/11 seen in group of 13 without calf
- 29 Feb/12 seen in group of 2 without calf
- 4 Mar/13 seen in group of 5 without calf
- 3 Mar/14 seen alone without calf

Caribou #182 (GPS, died)
- 26 Feb/10 collared
- 1 Mar/10 seen with cow
- 1 Mar/11 seen in group of 7 with calf
- 1 Mar/12 seen in group of 3 with calf
- Died 5 Aug/12
- 2 Oct/12 collar retrieved

Caribou #181 (Sat, died)
- 26 Feb/10 collared
- 1 Mar/10 seen in group of 3 without calf
- 1 Mar/11 seen in group of 4 with calf
- Died 25 Apr/11

Caribou #180 (Sat, died)
- 26 Feb/10 collared
- 1 Mar/10 seen in group of 8 with calf
- 1 Mar/11 seen in group of 5 with calf
- 29 Feb/12 seen in group of 3 without calf
- Died 12 July/12

Caribou #179 (GPS, died)
- 25 Feb/10 collared
- 2 Mar/10 seen in group of 11 with calf
- Died 25 Nov/10
- 22 Feb/11 collar retrieved on Trout Lake

Caribou #178 (Sat, died)
- 25 Feb/10 collared
- 1 Mar/10 seen in group of 3 with calf
- Died 8 Oct/10

- 1 Mar/11 no signal at location

Caribou #177 (GPS, released)
- 25 Feb/10 collared
- 2 Mar/10 seen alone
- 25 Feb/11 seen with calf
- 1 Mar/12 seen in group of 9 without calf
- 6 Mar/13 seen in group of 2 with calf
- 15 June/13 released
- 11 Sept/13 collar retrieved

Caribou #176 (Sat, died)
- 25 Feb/10 collared
- 2 Mar/10 seen in group of 3 without calf
- 25 Feb/11 seen in group of 7 without calf
- 1 Mar/12 seen with calf
- Died 13 Aug/12
- 2 Oct/12 collar retrieved

Caribou #175 (Sat, died)
- 25 Feb/10 collared
- 2 Mar/10 seen in group of 5 without calf
- Died 6 Sep/10
- 23 Nov/10 no caribou at signal location - inaccessible

Caribou #174 (GPS, released)
- 24 Feb/10 collared
- 1 Mar/10 seen with cow
- 1 Mar/11 seen in group of 5 with calf
- 29 Feb/12 seen in group of 8 with calf
- 4 Mar/13 seen in group of 11 without calf
- 15 June/13 released
- 11 Sept/13 collar retrieved

Caribou #173 (GPS, died)
- 24 Feb/10 collared
- 1 Mar/10 seen in group of 8 with calf
- 1 Mar/11 seen in group of 5 without calf
- Died 16 Apr/11
- 24 Apr/12 collar retrieved

Caribou #172 (Sat)
- 24 Feb/10 collared
- 1 Mar/10 seen with calf
- 1 Mar/11 seen in group of 3 with calf
- 29 Feb/12 seen in group of 4 without calf
- 4 Mar/13 seen in group of 15 without calf
- 3 Mar/14 seen in group of 2 without calf

Caribou #171 (Sat)
- 24 Feb/10 collared
- 1 Mar/10 seen in group of 13 with #160 with calf
- 1 Mar/11 seen in group of 7 with calf
- 29 Feb/12 seen in group of 5 with calf
- 4 Mar/13 seen in group of 3 with calf
- 3 Mar/14 seen in group of 4 without calf

Caribou #170 (Sat, died)
- 23 Feb/10 collared
- 2 Mar/10 seen in group of 7 with #137 with calf
- 2 Mar/11 seen in group of 7 without calf
- 2 Mar/12 seen in group of 4 with #169 but without calf
- 5 Mar/13 seen in group of 10 with #169, #204 with calf
- 5 Mar/13 seen in group of 10 with #169, #204 with calf
- Died 29-31 Oct/13

Caribou #169 (GPS, released)
- 23 Feb/10 collared
- 2 Mar/10 seen alone
- 2 Mar/11 seen with calf

- 2 Mar/12 seen in group of 4 with #170 but without calf
- 5 Mar/13 seen in group of 10 with #170, #204 with calf
- 15 June/13 released

Caribou #168 (GPS, released)
- 19 Feb/09 collared
- 2 Mar/09 seen in group of 5 without calf
- 1 Mar/10 seen in group of 4 with calf
- 1 Mar/11 seen in group of 9 with calf
- 1 Jan/12 ceased satellite transmissions
- 29 Feb/12 seen in group of 4 with calf
- 10 June/12 released

Caribou #167 (GPS, died)
- 18 Feb/09 collared
- 3 Mar/09 seen in group of 7 without calf
- Died 22 Mar/09
- 5 Jun/09 collar retrieved

Caribou #166 (GPS, died)
- 19 Feb/09 collared
- 2 Mar/09 seen in group of 10 with #155 but without calf
- 1 Mar/10 seen in group of 4 without calf
- 1 Mar/11 seen alone
- Died 30 Oct/11

Caribou #165 (GPS, released)
- 19 Feb/09 collared with calf
- 2 Mar/09 seen in group of 14 with calf
- 1 Mar/10 seen in group of 10 with calf
- 1 Mar/11 seen in group of 9 with calf
- 29 Feb/12 seen with calf
- 10 June/12 released

Caribou #164 (GPS, released)
- 18 Feb/09 collared
- 3 Mar/09 seen in group of 4 without calf
- 2 Mar/10 seen in group of 3 without calf
- 2 Mar/11 seen with calf
- 2 Mar/12 seen in group of 6 without calf
- 10 June/12 released

Caribou #163 (GPS, died)
- 19 Feb/09 collared
- 3 Mar/09 seen in group of 9 without calf
- 1 Mar/10 seen with calf
- Died 15 April/10
- 14 Jun/10 signal from under ice on Liard River
- 3 Aug/10 collar unfrozen, ice has melted
- 5 Aug/10 collar retrieved

Caribou #162 (GPS, harvested)
- 19 Feb/09 collared
- 2 Mar/09 seen in group of 11 without calf
- 3 May/09 shot by harvester
- 24 May/09 collar retrieved

Caribou #161 (Sat, released)
- 18 Feb/09 collared
- 2 Mar/09 seen in group of 5 without calf
- 2 Mar/10 seen with cow
- 12 Nov/10 satellite transmission ceased
- 2 Jun/11 released

Caribou #160 (Sat, released)
- 17 Feb/08 collared with calf
- 3 Mar/08 seen in group of 5 with calf
- 28 May/08 no visual
- 2 Mar/09 seen in group of 14 without calf
- 1 Mar/10 seen in group of 13 with #171 and with calf

- 1 Mar/11 seen alone
- 29 Feb/12 seen in group of 6 with calf
- 4 Mar/13 seen in group of 4 without calf
- 7 Mar/13 released

Caribou #159 (Sat, released)

- 16 Feb/08 collared
- 4 Mar/08 seen in group of 24 without calf
- 21 Apr/08 located with 134
- 28 May/08 seen without calf
- 3 Mar/09 seen in group of 8 without calf
- 1 Mar/10 seen in group of 10 without calf
- 2 Mar/11 seen in group of 16 with #134 but without calf
- 2 Mar/12 seen in group of 7 without calf
- 5 Mar/13 seen in group of 8 with calf
- 7 Mar/13 released

Caribou #158 (Sat, died)

- 17 Feb/08 collared
- 3 Mar/08 seen with cow
- 28 May/08 seen with calf
- 2 Mar/09 seen in group of 6 with calf
- Died 2 June/09, couldn't find death date, was underwater
- 2 Jun/09 collar retrieved

Caribou #157 (Sat, released)

- 17 Feb/08 collared
- 3 Mar/08 seen in group of 5 without calf
- 23 May/08 lost satellite signal
- 29 May/08 seen in group of 3 with calf
- 2 Mar/09 seen in group of 5 with calf
- 1 Mar/10 seen in group of 5 without calf
- 30 Sep/10 collar released

Caribou #156 (GPS, died)

- 18 Feb/08 collared with calf
- 4 Mar/08 seen in group of 4 with calf
- 29 May/08 seen without calf
- 3 Mar/09 seen in group of 14 with calf
- Died 14 Apr/09
- 13 Jul/09 collar retrieved

Caribou #155 (GPS, harvested)

- 17 Feb/08 collared
- 3 Mar/08 seen in group of 6 without calf
- 28 May/08 seen with calf
- 2 Mar/09 seen in group of 10 with #166 but without calf
- Died 29 Jul/09 shot by harvester
- 21 Sep/09 collar retrieved

Caribou #154 (GPS, released)

- 17 Feb/08 collared
- 5 Mar/08 seen in group of 19 without calf
- 29 May/08 seen with calf
- 4 Mar/09 seen in group of 5 with calf
- 2 Mar/10 seen in group of 7 with calf
- 2 Mar/11 seen with calf
- 1 Jul/11 collar released

Caribou #153 (GPS, released)

- 16 Feb/08 collared with calf
- 4 Mar/08 seen in group of 4 without calf
- 29 May/08 seen without calf
- 2 Mar/09 seen in group of 5 with calf
- 2 Mar/10 seen in group of 4 with calf
- 2 Mar/11 seen in group of 6 without calf
- 1 Jul/11 collar released

Caribou #152 (GPS, died)

- 23 Jan/07 collared

- 27 Feb/07 seen in group of 6 without calf
- 30 May/07 seen with calf
- 4 Mar/08 seen with cow
- 30 May/08 seen with calf
- 3 Mar/09 seen in group of 10 without calf
- 2 Mar/10 seen in group of 9 with calf
- Died 25 Mar/10
- 21 May/10 tried to relocate by helicopter, too much water
- 22 Feb/11 ground relocation attempt but no signal
- 28 Aug/12 collar retrieved, VHF stopped working

Caribou #151 (GPS, harvested)

- 22 Jan/07 collared
- 26 Feb/07 seen in group of 6 without calf
- 29 May/07 seen with calf
- 3 Mar/08 seen in group of 8 without calf
- 28 May/08 seen with calf
- Died 9 Aug/08 by Fish Lake likely shot by harvester
- 2 Jun/09 collar retrieved

Caribou #150 (GPS, harvested)

- 22 Jan/07 collared
- 26 Feb/07 seen in group of 2 without calf
- 29 May/07 seen with calf
- 3 Mar/08 seen with cow
- Died 15 May/08 likely shot by harvester
- 17 Jun/08 collar retrieved

Caribou #149 (GPS, released)

- 24 Feb/07 collared
- 27 Feb/07 seen in group of 7 without calf
- 30 May/07 seen with calf
- 4 Mar/08 seen in group of 10 without calf
- 29 May/08 seen with calf
- 3 Mar/09 seen in group of 9 with calf
- 3 Mar/10 seen in group of 12 without calf
- 2 Jun/10 collar released
- 8 Oct/10 collar retrieved

Caribou #148 (Sat, released)

- 24 Jan/07 collared
- 26 Feb/07 seen in group of 12 without calf
- 30 May/07 seen without calf
- 4 Mar/08 seen with calf
- 29 May/08 seen with calf
- 2 Mar/09 seen in group of 3 without calf
- 30 Sep/09 collar released
- 2 Mar/10 collar located from air in inaccessible area

Caribou #147 (Sat, died)

- 22 Jan/07 collared
- 26 Feb/07 seen in group of 8 without calf
- 30 May/07 seen without calf
- 3 Mar/08 seen in group of 9 without calf
- 28 May/08 seen with calf
- Died 17 July/08
- 17 Aug/09 collar retrieved

Caribou #146 (Sat, released)

- 21 Jan/07 collared
- 27 Feb/07 see in group of 11 with calf
- 30 May/07 seen with calf
- 4 Mar/08 seen in group of 4 with calf
- 29 May/08 seen without calf
- 2 Jul/08 lost satellite signal
- 3 Mar/09 seen in group of 3 with #108 but without calf
- 2 Mar/10 seen in group of 4 with calf
- 30 Sep/10 collar released

Caribou #145 (Sat, released)

- 21 Jan/07 collared

- 27 Feb/07 seen in group of 3 without calf
- 30 May/07 seen without calf
- 3 Mar/08 seen in group of 4 with calf
- 29 May/08 seen with calf
- 2 Jul/08 lost satellite signal
- 2 Mar/09 seen in group of 5 with calf
- 1 Mar/10 seen in group of 4 with calf
- 30 Sep/10 collar released

Caribou #144 (Sat, harvested)

- 23 Jan/07 collared
- 26 Feb/07 seen in group of 10 without calf
- Died 4 Apr/07 shot by harvester
- 12 Apr/07 collar retrieved

Caribou #143 (Sat, released)

- 21 Jan/07 collared
- 26 Feb/07 seen in group of 6 without calf
- 29 May/07 seen with calf
- 20 Nov/07 seen in group of 4
- 04 Sep/07 lost satellite transmission
- 4 Mar/08 seen in group of 6 without calf
- 26 Mar/08 located, no visual
- 21 Apr/08 located, no visual
- 29 May/08 not located, no signal
- 3 Mar/09 seen in group of 2 without calf
- 14 May/09 located, no visual
- 1 Jun/09 seen with calf
- 9 Jul/09 located, no visual
- 12 Aug/09 located, no visual
- 2 Sept/09 located, no visual
- 28 Oct/09 located, no visual
- 22 Nov/09 located, no visual
- 22 Feb/10 located, no visual
- 2 Mar/10 seen in group of 4 without calf
- 3 Aug/10 located, no visual
- 30 Sep/10 collar released
- 23 Nov/10 no caribou at collar location
- 31 Jan/11 no caribou at signal location

Caribou #142 (Sat, unknown status)

- 22 Jan/07 collared
- 26 Feb/07 seen in group of 10 without calf
- 29 May/07 seen with calf
- 3 Mar/08 seen in group of 4 without calf
- Died before 9 May/08
- 28 May/08 no VHF signal from last known satellite location, collar likely underwater

Caribou #141 (Sat, died)

- 23 Jan/07 collared
- 26 Feb/07 seen in group of 2 without calf
- Died 16 Apr/07
- 13 Jul/07 collar retrieved

Caribou #140 (GPS, died)

- 24 Jan/07 collared
- 26 Feb/07 seen in group of 3 without calf
- 30 May/07 seen without calf
- Died 28 Oct/07
- 25 Apr/08 collar retrieved

Caribou #139 (GPS, died)

- 21 Jan/07 collared
- 27 Feb/07 seen in group of 6 without calf
- 30 May/07 seen in group of 4 with calf
- 3 Mar/08 seen with calf
- 29 May/08 seen with calf
- 2 Mar/09 seen in group of 3 without calf
- Died 7 July/09
- 10 Aug/09 collar retrieved

Caribou #138 (GPS, released)

- 23 Jan/07 collared

- 27 Feb/07 seen in group of 4 without calf
- 30 May/07 seen without calf
- 4 Mar/08 seen in group of 8 without calf
- 29 May/08 seen with calf
- 3 Mar/09 seen in group of 17 without calf
- 2 Mar/10 seen in group of 3 without calf
- 2 Jun/10 collar released

Caribou #137 (GPS, released)

- 23 Jan/07 collared
- 27 Feb/07 seen in group of 5 without calf
- 29 May/07 seen with calf
- 5 Mar/08 seen with calf
- 29 May/08 seen in group of 3 with calf
- 3 Mar/09 seen in group of 13 with calf
- 2 Mar/10 seen in group of 7 with #170 with calf
- 2 Jun/10 collar released
- 3 Aug/10 no caribou at signal location
- 23 Nov/10 no caribou at signal location

Caribou #136 (GPS, released)

- 23 Jan/07 collared
- 26 Feb/07 seen in group of 5 without calf
- 29 May/07 seen without calf
- 5 Mar/08 seen in group of 19 without calf
- 29 May/08 seen with calf
- 7 Mar/09 seen in group of 7 without calf
- 2 Mar/10 seen in group of 3 without calf
- 2 Jun/10 collar released
- 3 Aug/10 no caribou at signal location

Caribou #135 (VHF, died)

- 21 Jan/06 collared
- 1 Mar/06 seen in group of 4 without calf
- 30 May/06 without calf
- 28 Sep/06 no visual
- 23 Feb/07 seen in group of 6 without calf
- Died 23-28 May/07
- 31 May/07 collar retrieved

Caribou #134 (VHF, released)

- 21 Jan/06 collared
- 1 Mar/06 seen in group of 3
- 29 May/06 seen with calf
- 16 Sep/06 seen in group of 4
- 26 Feb/07 seen in group of 2 without calf
- 29 May/07 seen without calf
- 15 Feb/08 seen in group of 13 without calf
- 4 Mar/08 seen in group of 24 without calf
- 26 Mar/08 located, no visual
- 21 Apr/08 located with #159
- 28 May/08 seen with calf
- 3 Mar/09 seen in group of 9 with calf
- 14 May/09 located, no visual
- 1 Jun/09 seen with calf
- 9 Jul/09 located, no visual
- 12 Aug/09 located, no visual
- 2 Sep/09 located, no visual
- 28 Oct/09 located, no visual
- 22 Nov/09 located, no visual
- 22 Feb/10 located, no visual
- 1 Mar/10 seen in group of 3 with calf
- 14 Jun/10 located, no visual
- 3 Aug/10 located, no visual
- 23 Nov/10 located, no visual
- 31 Jan/11 located, no visual
- 1 Mar/11 seen in group of 16 including #159 and with calf
- 4 July/11 collar released

Caribou #133 (VHF, unknown status)

- 21 Jan/06 collared
- 1 Mar/06 seen with calf

- 30 May/06 seen with calf
- 23 Jan/07 seen in group of 10 without calf
- 26 Feb/07 seen in group of 3 without calf
- 29 May/07 seen with calf
- Unable to relocate since Dec/07
- 4 July/11 collar released

Caribou #132 (VHF, released)

- 22 Jan/06 collared
- 1 Mar/06 seen in group of 9 with calf
- 29 May/06 approx. location not pregnant
- 16 Sep/06 seen in group of 2 without calf
- 26 Feb/07 seen in group of 3 without calf
- 30 May/07 seen with calf
- 15 Feb/08 seen in group of 5 without calf
- 4 Mar/08 seen in group of 5 without calf
- 26 Mar/08 located, no visual
- 21 Apr/08 located, no visual
- 29 May/08 not located
- 1 Mar/09 collar released
- 2 Mar/09 located collar in mortality mode, no caribou at signal location

Caribou #131 (Sat, released)

- 22 Jan/06 collared
- 1 Mar/06 seen with calf
- 29 May/06 without calf
- 16 Sep/06 seen in group of 3 cows without calf
- 21 Jan/07 seen in group of 5 with calf
- 27 Feb/07 seen in group of 5 without calf
- 30 May/07 seen with calf
- 03 Mar/08 seen in group of 8 with calf
- 29 May/08 seen with calf
- 2 Mar/09 seen in group of 4 with calf
- 15 Apr/09 collar released

Caribou #130 (Sat, died, non-predation)

- 22 Jan/06 collared
- 1 Mar/06 seen in group of 7 without calf
- 29 May/06 without calf
- Died 5 Jul/06, death related to malnutrition
- 23 Aug/06 collar retrieved

Caribou #129 (Sat, died)

- 20 Jan/06 collared
- 1 Mar/06 seen in group of 6 without calf
- 30 May/06 seen with calf
- 16 Sep/06 with calf
- 21 Jan/07 seen in group of 4 with calf
- 26 Feb/07 seen in group of 10 with calf
- 29 May/07 seen with calf
- 05 Mar/08 seen without calf
- Died 27 May/08
- 29 May/08 collar retrieved

Caribou #128 (Sat, released)

- 20 Jan/06 collared
- 2 Mar/06 seen in group of 5 without calf
- 30 May/06 seen in group of 4 with calf
- 16 Sep/06 seen in group of 3 without calf
- 27 Feb/07 seen in group of 5 without calf
- 29 May/07 seen with calf
- 04 Mar/08 seen in group of 10 with calf
- 29 May/08 seen with calf
- 22 Oct/08 collar finished transmitting
- 3 Mar/09 seen in group of 3 with calf
- 2 Mar/10 seen in group of 7 without calf

- 3 Mar/10 collar released

Caribou #127 (Sat, died)

- 22 Jan/06 collared
- 1 Mar/06 seen in group of 7 with calf
- 29 May/06 seen with calf
- Died 21 Jul/06
- 16 Sep/06 confirm wolf predation
- 23 Oct/06 collar retrieved

Caribou #126 (Sat, died)

- 21 Jan/06 collared
- 1 Mar/06 seen in group of 5 with yearling
- 30 May/06 seen with calf
- 26 Feb/07 seen in group of 13 without calf
- 29 May/07 seen without calf
- 03 Mar/08 seen in group of 14 without calf
- 28 May/08 seen with calf
- 2 Mar/09 seen in group of 5 without calf
- Died 28 Apr/09
- 8 Jun/10 collar retrieved

Caribou #125 (Sat, died)

- 22 Jan/06 collared
- 1 Mar/06 seen in group of 16 with yearling
- 29 May/06 seen with small calf
- Died 12-15 Jul/06, likely wolf predation
- 16 Sep/06 no visual
- 23 Oct/06 collar retrieved

Caribou #124 (Sat, died)

- 20 Jan/06 collared
- 2 Mar/06 seen in group of 7 without calf
- Died 10 April/06, likely wolf predation
- 23 Aug/06 collar retrieved

Caribou #123 (Sat, died)

- 20 Jan/06 collared
- 2 Mar/06 seen in group of 4 with calf
- 29 May/06 without calf
- 16 Sep/06 seen in group of 3
- Died 5 Nov/06 on Trainor Lake
- 15 Feb/07 locate collar in ice
- 27 Feb/07 collar retrieved

Caribou # 122 (Sat, harvested)

- 4 Mar/05 collared
- 21 Mar/05 seen in group of 3
- 30 Mar/05 seen in group of 3
- 1 Jun/05 seen alone without calf
- 4 Jun/05 no visual
- 23 Sep/05 no visual
- 10 Oct/05 no visual
- 31 Nov/05 no satellite signal
- 4 Apr/05 got satellite signal back
- 30 May/05 seen without calf
- 24 Nov/06 no satellite signal
- 15 Jun/07 collar went off air finishing transmissions
- 14 Apr/14 caribou shot by harvester
- 15 Apr/11 collar handed in by harvester

Caribou #121 (Sat, died)

- 4 Mar/05 collared
- 21 Mar/05 seen in group of 3
- Died 26-27 Mar/05 predated by wolves
- 30 Mar/05 collar retrieved

Caribou #120 (Sat, released)

- 4 Mar/05 collared
- 21 Mar/05 seen in group of 13
- 30 Mar/05 seen in group of 3
- 1 Jun/05 no visual
- 4 Jun/05 seen alone without calf
- 23 Sep/05 seen in group of 14
- 10 Oct/05 no visual
- 16 Jan/06 seen in group of 3
- 1 Mar/06 seen in group of 5
- 30 May/06 without calf

- 26 Feb/07 seen in group of 10 without calf
- 30 May/07 seen without calf
- 7 Dec/07 seen in group of 4 without calf
- 3 Mar/08 seen in group of 4 without calf
- 28 May/08 seen with calf
- 7 Oct/08 transmissions from collar ceased
- 2 Mar/09 see in group of 6 without calf
- 3 Mar/09 collar released
- 29 Aug/09 collar retrieved

Caribou # 119 (Sat, released)

- 4 Mar/05 collared
- 21 Mar/05 seen in group of ≥8
- 30 Mar/05 no visual
- 1 Jun/05 seen alone without calf
- 23 Sep/05 no visual
- 10 Oct/05 no visual
- 16 Jan/06 in group of 5 without calf
- 1 Mar/06 in group of 4
- 30 May/06 with calf
- 22 Jan/07 in group of 3 with calf
- 26 Feb/07 in group of 11 with calf
- 29 May/07 seen without calf
- 3 Mar/08 seen with cow
- 28 May/08 seen with calf
- 10 Sep/08 satellite transmissions ceased
- 2 Mar/09 seen in group of 5 without calf
- 3 Mar/09 collar released
- 2 Jun/09 collar retrieved

Caribou # 118 (Sat, died)

- 4 Mar/05 collared
- 21 Mar/05 seen in group of 10
- 30 Mar/05 seen in group of 9
- 1 Jun/05 no visual
- 4 Jun/05 no visual
- Died 13 Jun/05, likely wolf predation
- 6 Sep/05 collar retrieved

Caribou #117 (Sat, died)

- 3 Mar/05 collared
- 31 May/05 seen alone without calf
- 10 Jun/05 seen in thick brush
- 23 Sep/05 seen in group of at least 4
- 26 Jan/06 seen in group of 4 with calf
- 2 Mar/06 seen in group of 5 with calf
- Died 18 Apr/06
- 23 Aug/06 collar retrieved

Caribou #116 (Sat, released)

- 3 Mar/05 collared
- 31 May/05 seen alone without calf
- 10 Jun/05 no visual
- 23 Sep/05 seen in group of 3
- 26 Jan/06 seen in group of 7 with calf
- 2 Mar/06 seen in group of 4 with calf
- 29 May/06 seen with calf
- 16 Sep/06 seen in group of 2 without calf
- 23 Jan/07 seen in group of 12 without calf
- 27 Feb/07 seen in group of 6 without calf
- 30 May/07 seen in group of 3 with calf
- 4 Mar/08 seen with bull
- 29 May/08 seen with calf
- 13 Oct/08 satellite transmission ceased
- 3 Mar/09 seen in group of 17 without calf
- 3 Mar/09 collar released
- 7 Jul/09 collar retrieved

Caribou #115 (Sat, released)

- 3 Mar/05 collared
- 10 Apr/05 seen in group of 3

- 31 May/05 seen alone without calf
- 23 Sep/05 no visual
- 5 Oct/05 seen in group of 2 without calf
- 2 Mar/06 seen in group of 9 without calf
- 30 May/06 seen in group of 2 without calf
- 16 Sep/06 seen in group of 4 without calf
- 27 Feb/07 seen in group of 4 without calf
- 29 May/07 seen with calf
- 04 Mar/08 seen with 2 cows
- 30 May/08 seen with calf
- 1 Oct/08 satellite transmissions ceased
- 4 Mar/09 seen in group of 3 with calf
- 3 Mar/09 collar released
- 10 Aug/09 collar retrieved

Caribou #114 (Sat, released)

- 3 Mar/05 collared
- 10 Apr/05 seen in group of 9
- 31 May/05 no visual
- 10 Jun/05 seen alone without calf
- 23 Sep/05 no visual
- 2 Mar/06 seen in group of 6 without calf
- 29 May/06 seen in group of 3 without calf
- 16 Sep/06 seen in group of 3 without calf
- 27 Feb/07 seen in group of 6 without calf
- 30 May/07 seen with without calf
- 4 Mar/08 seen in group of 7 without calf
- 29 May/08 seen with calf
- 3 Jul/09 satellite transmissions ceased
- 3 Mar/09 seen in group of 13 with calf
- 3 Mar/09 collar released
- 1 Jun/09 collar retrieved

Caribou #113 (Sat, died)

- 3 Mar/05 collared
- 10 Apr/05 seen in group of 4
- 31 May/05 no visual
- 10 Jun/05 seen alone without calf
- Died 10 Sep/05 likely wolf predation
- 5 Oct/05 collar retrieved

Caribou #112 (Sat, released)

- 3 Mar/05 collared
- 10 Apr/05 seen with calf
- 31 May/05 seen with calf
- 10 Jun/05 seen with calf
- 23 Sep/05 no visual
- 1 Mar/06 seen in group of 6 with calf
- 30 May/06 seen in group of 4 with calf
- 16 Sep/06 seen with calf
- 27 Feb/07 seen in group of 5 with calf
- 29 May/07 seen with calf
- 5 Mar/08 seen with 2 bulls
- 30 Jun/08 located, no visual
- 22 Oct/08 satellite transmission ceased
- 3 Mar/09 collar released
- 6 Jul/09 collar retrieved

Caribou #111 (Sat, released)

- 3 Mar/05 collared
- 5 May/05 seen in group of 2
- 31 May/05 seen with calf
- 23 Sep/05 seen in group of 5 with calf
- 1 Mar/06 seen in group of 9 without calf
- 29 May/06 seen with calf
- 16 Sep/06 seen in group of 3
- 24 Jan/07 seen in group of 14
- 27 Feb/07 seen in group of 4 with calf
- 30 May/07 seen with calf

- 4 Mar/08 seen in group of 8 with calf
- 28 May/08 seen with calf
- 11 Nov/08 satellite transmission ceased
- 3 Mar/09 seen in group of 11 with calf
- 3 Mar/09 collar released
- 10 Jul/09 collar retrieved

Caribou #110 (Sat, died)

- 5 Mar/05 collared
- 5 May/05 seen alone without calf
- 31 May/05 seen alone without calf
- Died 2 Jun/05 likely wolf predation
- 29 Jul/05 collar retrieved

Caribou #109 (Sat, died)

- 1 Apr/04 collared
- 29 May/04 no visual
- 22 Sep/04 seen in group of 4 without calf
- 31 May/05 seen with calf
- 19 Jun/05 seen with calf
- 23 Sep/05 no visual
- 5 Oct/05 seen in group of 3 with calf
- Died 22 Apr/06, likely wolf predation
- 23 Aug/06 collar retrieved

Caribou #108 (Sat, observed alive, no Sat or VHF active)

- 1 Apr/04 collared
- 29 May/04 seen alone without calf
- 3 Jun/04 no visual
- 22 Sep/04 seen in group of 3 without calf
- 25 Jan/05 seen in group of 4 without calf
- 31 May/05 no visual
- 10 Jun/05 no visual
- 19 Jun/05 seen with calf
- 23 Sep/05 no visual
- 5 Oct/05 seen in group of 5 with calf
- 2 Mar/06 seen in group of 3 with yearling
- 30 May/06 seen with calf
- 23 Jan/06 seen in group of 5 with calf
- 27 Feb/07 seen in group of 11 with calf
- 30 May/07 seen in group of 3 with calf
- 15 Jun/07 satellite transmissions ceased
- 3 Mar/09 seen in group of 3 with #146, no VHF transmissions

Caribou #107 (Sat, died)

- 1 Apr/04 collared
- 29 May/04 no visual
- 22 Sep/04 seen in group of 3 with calf
- Died 22 Apr/05 likely wolf predation
- 4 May/05 collar retrieved

Caribou #106 (Sat, died)

- 30 Mar/04 collared
- 29 May/04 no visual
- 3 Jun/04 seen in group of 2 with calf
- 22 Sep/04 seen in group of 7 without calf
- 25 Jan/05 seen in group of 5 without calf
- 31 May/05 seen alone without calf
- 23 Sep/05 seen in group of 2 without calf
- Died 12 Nov/05, likely wolf predation
- 30 May/06 collar retrieved

Caribou #105 (Sat, died)

- 30 Mar/04 collared
- 29 May seen in group of 3 with calf
- 22 Sep/04 no visual

- 25 Jan/05 seen in group of 3 without calf
- 31 May/05 seen alone without calf
- 19 Jun/05 seen alone without calf
- 23 Sep/05 no visual
- 2 Mar/06 seen in group of 11 without calf
- Died 13 May/06, likely wolf predation
- 23 Aug/06 collar retrieved

Caribou #104 (Sat, died, non-predation)

- 29 Mar/04 collared
- 29 May/04 seen in group of 3 without calf
- 3 Jun/04 seen in group of 3 without calf
- 22 Sep/04 no visual
- Died 13 Apr/05, death related to malnutrition
- 4 May/05 collar retrieved

Caribou #103 (Sat, died)

- 1 Apr/04 collared
- 29 May/04 seen in group of 3 with calf
- 22 Sep/04 no visual
- Died 16 Apr/05, likely wolf predation
- 4 May/05 collar retrieved

Caribou #102 (Sat, died)

- 29 Mar/04 collared
- Died 5 May/04, wolf predation
- 3 Jun/04 collar retrieved

Caribou # 101 (Sat, died)

- 30 Mar/04 collared
- Died 5 May/04, likely wolf predation
- 9 Aug/04 collar retrieved

Caribou # 100 (Sat, no Sat or VHF active)

- 29 Mar/04 collared
- 29 May/04 seen in group of 3 without calf
- 3 Jun/04 seen alone without calf
- 22 Sep/04 no visual
- 25 Jan/05 seen in group of 11, without calf
- 31 May/05 seen in group of 3 with calf
- 19 Jun/05 seen alone without calf
- 23 Sep/05 problems with VHF transmission
- 30 Oct/06 problems with satellite transmission
- 6 Feb/06 no satellite/VHF signal
- 27 Feb/07 no visual
- 30 May/07 no visual
- 15 Jun/07 satellite transmission ceased